The South African Journal
of
Medical Laboratory Technology

ORGAN OF THE SOCIETY OF MEDICAL LABORATORY TECHNOLOGISTS OF SOUTH AFRICA

Vol. 2, No. 1 A QUARTERLY March, 1956

EDITOR:
S. E. DODDS

Single Numbers 5/6 Annual Subscription £1/1/0

OFFICERS OF THE NATIONAL SOCIETY

☆ ☆ ☆

Chairman: Dr. F. A. BRANDT, c/o S.A.I.M.R., P.O. Box 1038, *Johannesburg.*

Secretary-Treasurer: Mr. G. W. WIKELEY, c/o Central Pathological Laboratory, Private Bag, Jacobs, Natal.

❖

Branch Secretaries:

CAPE: Mr. J. MAYTHAM, Dept. of Bacteriology, Medical School, Mowbray, Cape.

SOUTHERN TRANSVAAL: Mrs. G. TOMLIN, P.O. Box 1038, Johannesburg.

THE SOUTH AFRICAN JOURNAL OF MEDICAL LABORATORY TECHNOLOGY

Editorial Board:

Miss S. E. DODDS *(Chairman and Editor).*
Mr. P. N. BUCK *(Secretary and Advertising Manager).*
Mr. R. HORNER *(Circulation Manager).*
Mr. W. G. POWELL.
Mr. A. J. S. GREENFIELD.

❖

Correspondents:

Dr. F. A. BRANDT, Mr. H. FLEETWOOD-HOWARD, Mr. M. H. LELLO, Mr. J. H. MAYTHAM.

Printed by Process Printers, Ltd., Berea Road, Durban, and published by the Society of Medical Laboratory Technologists of South Africa, c/o Central Pathological Laboratory, Private Bag, Jacobs, Natal.

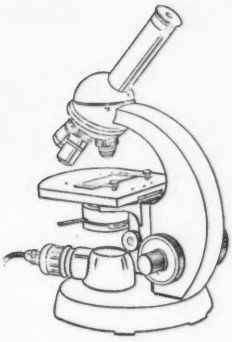
CARL ZEISS

The Name of ZEISS is inseparably linked with the Conception of . . .

Quality

and

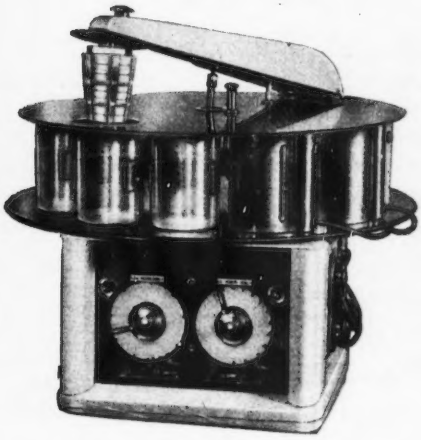
Reliability



Microscopes for all purposes from

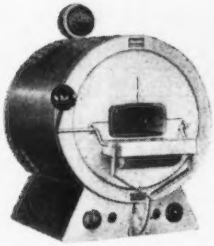
Optical Instruments (Pty.) Ltd.

P.O. Box 1561 + JOHANNESBURG



ELLIOT

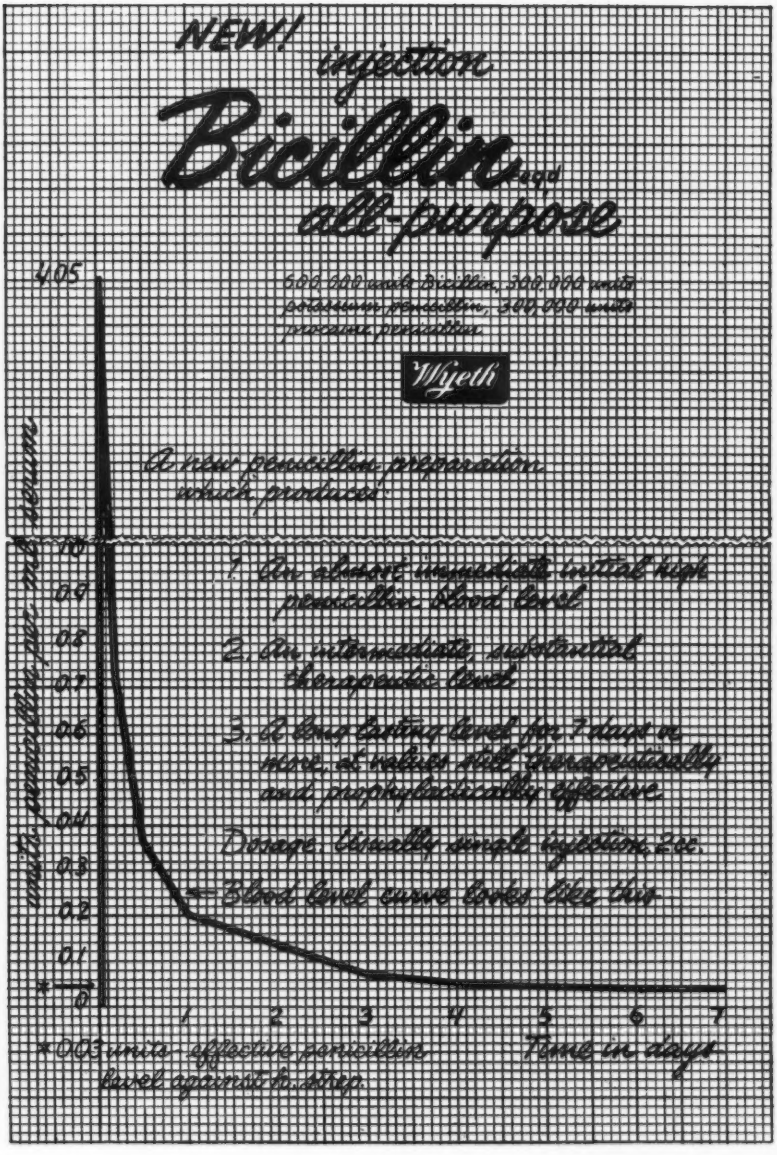
Tissue Processing Equipment



HERACUS

Electrical Laboratory Equipment of Highest Quality

CONSULT US FOR EXPERT REPAIR SERVICE


NEW!
injection
Bicillin
high
all-purpose
600,000 units Bicillin, 300,000 units potassium penicillin, 300,000 units procaine penicillin
Wyeth
A new penicillin preparation which produces
1. An almost immediate initial high penicillin blood level
2. An intermediate, substantial therapeutic level
3. A long lasting level for 7 days or more, of values still therapeutically and prophylactically effective
Dosage: Usually single injection, 2 cc.
Blood level curve looks like this
4.05
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
Time in days
*.003 units effective penicillin level against b. stear.

FOR ALL YOUR LABORATORY REQUIREMENTS:–
VIR AL U LABORATORIUMBENODIGHEDE:–

• • •

APPARATUS	GLASSWARE	CHEMICALS
APPARAAT	GLAS	CHEMIKALIEE

• • •

HICKMAN & KLEBER (PTY.) LTD.
(EDMS.) BPK.

"THE CHEMICAL SUPPLY HOUSE"
„DIE CHEMIESE VOORSIENERS"

Phones 25380
Telefone 61797

271 UMBILO ROAD
UMBILOWEG 271
DURBAN
T.A. *Techserv*

P.O. Box 2805
Posbus

TOPICAL NEOMYCIN

The NEO-GELICIL range comprises . . .

EYEDROPS . . . . each c.c. contains Neomycin 5mg., Sodium Propionate 50 mg.

EARDROPS . . . . each c.c. contains Neomycin 3 mg., Chlorbutol 5 mg., Sodium Propionate 50mg., Benzalkonium Chloride 0.5 mg.

NOSEDROPS . . each c.c. contains Neomycin 2 mg., Phenylephrine Hydrochloride 2.5 mg., Pyrilamine Maleate 5 mg., Chlorbutol 5 mg., Benzalkonium Chloride 0.1 mg.

Neo-Gelicil Eyedrops are packed in ¼ oz. dropper bottles
Neo-Gelicil Nosedrops and Eardrops are packed in ½ oz. dropper bottles

Literature available from:

SAPHAR LABORATORIES LIMITED
P.O. Box 256 + Johannesburg

"GURR'S"

is the REGISTERED TRADE MARK of . . .
GEORGE T. GURR LTD.

Since 1915 "**GURR'S**" brand of MICROSCOPICAL STAINS and REAGENTS has become world famous.

If you want this world famous brand, specify "**GURR'S**" and refuse any other.

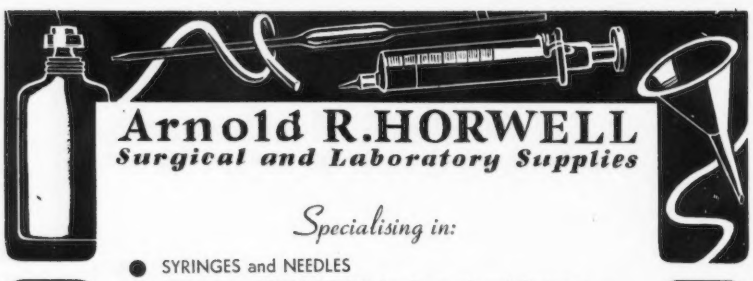
If you have any difficulty in getting "**GURR'S**" please write to us at our only address:

GEORGE T. GURR Ltd.

136/138 NEW KINGS ROAD + LONDON, S.W.6.

Sole Agents for the Union of South Africa . . . . B. Owen Jones Limited

JOHANNESBURG P.O. Box 9955 | CAPE TOWN P.O. Box 434 | DURBAN P.O. Box 557



Arnold R. HORWELL

Surgical and Laboratory Supplies

Specialising in:

- SYRINGES and NEEDLES
- SURGICAL INSTRUMENTS for Research and Students' use
- MICROSCOPE SLIDES of finest quality and COVER GLASSES
- VOLUMETRIC GLASSWARE, BLOOD TESTING APPARATUS
- THERMOMETERS
- POLYTHENE BOTTLES, BEAKERS and SUNDRIES
- SELF-ADHESIVE (TACKY) LABELS
- POLYTHENE and PVC TUBING

18, CHRISTCHURCH AVE., LONDON N.W.6 TEL: GLADSTONE 8777

The South African Journal
of
Medical Laboratory Technology

ORGAN OF THE SOCIETY OF MEDICAL LABORATORY TECHNOLOGISTS OF SOUTH AFRICA

Vol. 2, No. 1 A QUARTERLY March, 1956

CONTENTS

	Page
Editorial	2
Redaksioneel	2
Examination Successes	3
Paper Chromatography and its uses	4
A Practical Physical Model of a Portion of the Living Upright Human Spine	11
Accuracy and Reproducibility of Assay Values in Chemical Pathology	15
To Students and Others	17
Tissue Culture	19
International Congress of Medical Laboratory Technologists	22
Society News	22
Random Meanderings	26

SUPPORT THE FIRMS WHO SUPPORT YOUR SOCIETY'S JOURNAL

EDITORIAL

"ON CALL" PAYMENTS

Shortly after the publication of the last number of the Journal, in which the Editorial Column strongly advocated that payment should be made for "on call" duties, employees of the Natal Provincial Laboratory Service received a very welcome circular from the authorities stating that the Director of Provincial Medical and Health Services had agreed to approach the Provincial Executive Committee to discuss the possibility of obtaining payment for Medical Technologists for week-end duties and night calls. This meeting has yet to take place, and, at present, no details of the proposal are available; but, while authority for overtime payment has not yet been obtained, we are told that it is possible that retrospective payments may be made as from 1st January, 1956.

There must be few Medical Technologists who would not be highly gratified at the prospect of concrete recognition for "on call" work. We are by no means a mercenary group of people; we are well aware of the urgent nature of our work, and are fully prepared to do our utmost to help in an emergency. But we would undergo the disorganisation of our personal activities all the more willingly if we felt that our services were not being taken for granted. We should like to extend our very sincere thanks to the Natal Provincial authorities for making representations on our behalf, and we hope for a favourable outcome to the discussion at higher levels. This is a good beginning; and we hope that other employing bodies will very soon follow the precedent set by the N.P.A.

☆ ☆ ☆

REDAKSIONEEL

NAWEEK DIENSTE EN NAGOPROEP BETALINGS

Die redaksie het in die vorige uitgawe aanbeveel dat Mediese Tegnoloë besoldig word vir nagoproepe en oproepe gedurende die naweek. Kort na die uitgawe verskyn het, is 'n omsendbrief van die Provinsiale

Administrasie ontvang, waarin gemeld word dat die Direkteur van Provinsiale Mediese en Gesondheidsdienste toegestem het om die Provinsiale Uitvoerende Komitee te nader insake bespreking van besolding van Mediese Tegnoloë vir nagoproepe en naweeks dienste. Tans is geen besonderhede beskikbaar nie, aangesien die besprekings nog nie plaasgevind het nie. Intussen, egter, word dit op goeie gesag verneem, dat indien goedkeuring aan die voorstel verleen word, besoldiging vanaf die eerste Januarie 1956 sal dateer.

Die vooruitsig van besoldiging vir naweek dienste en nagoproepe word in die geheel verwelkom. Die dringende aard van ons werk en die verantwoordelikheid wat daarmee gepaard gaan, word goed begryp. In enige noodgeval is daar geen kwessie aangaande die algemene bereidwilligheid om volle steun te verleen nie, maar dit spreek vanself, dat ons selfs meer gewilliglik ons persoonlike aktiwiteite sal opsê in ons vrye tyd indien dit gedoen word in die wete dat ons bereidwilligheid nie bloot as vanselfsprekend aangeneem word nie. Ons wil graag ons persoonlike dank jeens die Natalse Provinsiale Administrasie uitspreek vir hul belangstelling, en ons vertrou dat die voorgestelde bespreking gunstig sal verloop. Dit is 'n goeie begin. Ons vertrou dat ander liggame die voorbeeld van die Natalse Provinsiale Administrasie sal volg.

☆ ☆ ☆

EXAMINATION SUCCESSES

The following candidates were successful in the examinations held in Natal in November, 1955.

Bacteriology and Serology Final:

Abrahamson, L. J.
Banning, Y. M.
Beneke, M. M.
Coetzee, E. F. C.
Foster, V. B.
Greenfield, A. J. S.
Higgs, V. F.
St. George, E. M. B.
Smit, S. Y.
Sutherland, M. E.
Wetteland, J. D.

There were 18 candidates for this examination.

Chemical Pathology Final:

Spiers, J. S.

There was one candidate for this examination.

Intermediate Examination:

Dowsett, T. L.
Khoza, B. N. (with distinctions)
Khumalo, V. T.
Majavu, V. M. X.
Shuttleworth, E. L.
Suter, F. M.

There were 8 candidates for this examination.

PAPER CHROMATOGRAPHY AND ITS USES (A REVIEW)

N. R. GREGORY
Public Health Laboratory, Salisbury

HISTORY

Pliny the Elder, an eminent naturalist who died at Pompeii in A.D. 79, can probably claim to being the original user of Paper Chromatography for the identification of substances. He used papyrus and extract of gall-nut to detect ferrous sulphate, but paper chromatography as we know it today originated from the early work conducted by Runge, Schoenbein, Goppelsroeder et al from 1860-1910.

Runge used a packed tower to separate plant chromogens, and this method, using precipitated chalk, was further used by Tsweat, who traced the formation of the bands to the fact that weakly absorbed pigments travelled faster through the absorbent material than the more strongly absorbed.

Schoenbein, while investigating dye components, used filter-paper strips to aid in their separation, recognising that in filter paper strips water travels faster than the solute in solution, and that in a mixture of components in solution, one component travels faster than the others.

Goppelsroeder, who was Schoenbein's student, applied this method to the separation of plant pigments, fats, alkaloids, etc. The principle was that the substances were absorbed on the filter paper direct from their solution; the solvent front and distance travelled by the substance was observed and correlated without the use of a developing solution. He used a chamber unit which differs very little from the more elaborate one in use today.

In 1939 Neuberger, in separating the neutral amino-acids, found that the partition coefficients of acetylated amino-acids between water and an immiscible organic solvent differed for the various amino-acids. This led to the production in 1941 of a continuous separation unit for amino-acids employing forty plates, by Martin & Synge, using silica gel as a support for the solvent flow.

Due to the inherent difficulties using this medium, Martin, Consden *et al* in 1944, substituted filter paper in place of silica gel as the inert support, and immediately found that it was no longer necessary to acetylate the amino-acids, which could now be detected directly on the paper by treatment with Ninhydrin.

This work really ushered in the present large field of Paper Chromatography.

At present most of the work has been concentrated on the detection of organic compounds, and many of the methods extant readily adapt themselves to the direct quantitative estimation of a substance(s) present.

But it is also possible to detect almost all of the inorganic anions and cations. The latter do not lend themselves so readily to quantitative estimation as the former, at present, especially in the biochemical field.

In this field the greatest assistance obtained from the use of Paper Chromatography is in the detection, identification and estimation of amino-acids, anti-biotics, reducing substances, porphyrins, vitamins and proteins in blood and urine.

PRINCIPLE

Although ion-exchange may have some effect on chromotographic separation, the predominant factor is usually that of the partition of the solute between two immiscible phases.

The movement of a solute zone may be conveniently explained as follows:—

(1) The celluolose fibres in the paper have a strong affinity for the water present in the solvent phase, but very little for the organic liquid, and they are thought of as an inert support holding a stationary aqueous phase.

(2) As the solvent flows through a section of the paper containing the solute, a partition of this compound occurs between the mobile organic phase and the stationary water phase. Thus some of the solute enters the organic phase, and when this organic phase reaches a section of paper containing no solute, partition again occurs, transferring the solute to the water phase in the paper.

Thus, with a continuous flow of solvent, the effect of this partition between the two phases is to transfer the solute from the point of its application on the paper to a point some distance along the paper in the direction of flow of the organic solvent phase.

This is analogous to fractional distillation.

It has been found that every substance that lends itself to Paper Chromatographic Separation will move along the paper a distance which is a definite fraction of the distance the solvent front has moved, for that solvent, i.e. the distance travelled by a solute varies from solvent to solvent, but is constant for each solvent.

This distance is designated as the Rf. of the substance for the solvent used, and is calculated by dividing the distance travelled by the solute from the start line, by the distance travelled by the solvent front from the same place in the same time.

The separations in practice are less than the theoretical due to the fact that the partition coefficient is seldom a constant, usually decreasing as the solution becomes stronger, resulting in the front of the Band or spot becoming sharper and the rear more diffuse and wider, since the concentrated front moves forward faster than the more dilute.

APPARATUS AND METHODS

Many different methods and techniques have been devised in the past 10 years, using both very complicated and very simple apparatus. Probably the most simple is that constructed from two pairs of petri dishes, using ordinary filter paper disks, and the most complicated the latest electriphoretic separation units for the separation of proteins.

The latter method has now become a separate type of analysis on its own which does not fall within the scope of this article.

The great advantage of paper chromatography lies in the fact that first class results may be obtained using relatively cheap and simple apparatus.

APPARATUS STANDARD TO ALL METHODS

(1) **Pipettes.** Small graduated pipettes to take 100 μ ml., graduated at 5 μ, 10 μ, 20 μ, 25 μ, 50 μ and 100 μ, which can be made in the laboratory. 1 μ = 0.001 ml. In America this volume is designated by lamda (λ) but μ is the accepted Continental and Canadian designation.

(2) **Sprays.** Small nasal "Atomizer" type, attached to a rotary blower or bellows type foot pump, for spraying developing reagents.

(3) **Oven.** Standard Laboratory Type Ovens which can attain temperatures of from 56°C. to 100°C. are all that is necessary. Temperatures of up to 110°C. may be used with safety, but certain of the reagents decompose if subjected to higher temperatures. The use of the lower temperatures tends to lengthen processing times, but satisfactory results are still obtained.

(4) **Filter Paper.** Many types will be found suitable, but Whatman No. 1 is one of the most widely used.

METHODS

(1) **Descending Strip Chromatography** (Consden, Gordon & Martin, 1944). This method was originally used for the partition of mixtures of amino-acids and can be used for the partition of reducing substances, porphyrins, vitamins and anti-biotics, etc.

The apparatus essentially consists of a filter paper strip usually from 30–50 cm. long, the upper end of which is immersed in a solvent contained in a trough. This hangs in an air-tight chamber, where the atmosphere is saturated in water and the solvent. The trough is provided with a side support bar over which the paper passes to prevent capillary siphoning. A standard 3" x 1" slide staining trough is suitable for this purpose, and a large bell-jar on a glass plate makes a very satisfactory airtight chamber. A tower to support the trough can be made out of sheet metal or Meccano, which, if well painted and waxed, is quite suitable.

BASIC TECHNIQUE

A piece of filter paper of from 30–50 cm. long and of suitable width for the trough is used. A pencil line about 10 cm. from the end is drawn across the strip, and about 5–10 μ of the solution to be analysed (depending on the concentration) is applied in the form of a spot to the centre position of the line from a pipette, and if necessary controls can be placed on either side. The spot(s) is then dried by suspending the paper strip horizontally in the oven; it must on no account be "blotted" dry, or allowed to dry in contact with any absorbent material. The end of the paper is now placed in the trough and held in place by a microscope slide. The trough and paper are then placed on the top of the tower in the chamber, the air in which has previously been saturated with a solvent by placing a two phase

mixture of water and solvent (usually the separated water layer which has been saturated with the solvent) inside the chamber about 15 minutes before use. The trough is then filled with the water saturated solvent and the cover replaced.

When the solvent has run a convenient distance, usually after about 15 hours (depending on paper used, temperature and solvent), the paper is removed, the solvent front marked, and the paper dried. It is then sprayed with a developer solution, suitable for detecting the expected constituents, e.g. benzidene, in the case of reducing substances, which indicates the reducing substance by a brown spot on a yellow background.

(2) Ascending Chromatography. This method was first used by Schoenbein, Goppelsroeder et al and in some ways gives more consistent results than the former method.

The chamber is of similar construction to that used in the previous method, e.g. a bell-jar. A container of the solvent is placed in the bottom, and a strip or usually a cylinder of filter-paper is immersed in it after treatment as in Method 1 and another container containing the water phase placed in the cabinet, and the solvent allowed to run as before. The development procedure is the same as in the first method.

(3) Two-way Paper Chromatography (Dent et al 1945). The method is basically the same as the preceding method but with this difference: 20 x 20 cm. squares of filter paper are used, either rolled into cylinders or suspended flat in a special square tank.

A "run" is made in one direction with one solvent; the paper dried, and then turned through 90° on its support and another run made using the side at right angles with another solvent. The paper is then dried, and developed as in the other methods. This particular method lends itself to the separation of Amino-Acids, where numerous constituents are often present. The amino-acid "Map of Spots" by this method will identify approximately 82 amino-acids which each give a two-dimensional Rf.

(4) Ascending-Descending Chromatography (Bloch 1950). This method combines the best of both preceding methods.

The filter paper, containing the spots to be analysed, is draped over a glass rod in an air-tight chamber, the long end being immersed in a long trough containing solvent, care being taken that the solvent flows upwards through the spots by capillary attraction up the paper and over the rod and down the other side. The basic technique is the same as for the other methods.

(5) Horizontal Phase Circular Chromatography (Rutter 1948). This method is probably the quickest and simplest of all the methods extant, giving a result within an hour, and using only petri dishes and ordinary 15 cm. filter paper circles (disks).

A "tail" is cut at the centre of a 15 cm. disk by making two parallel cuts about 1–2 cm. apart from the periphery up to the centre, and the tail bent at the joint perpendicular to the plane of the paper.

A measured volume of the solution to be analysed is placed on the joint and air-dried. The disk is then placed between two upper or lower sections of a petri dish, with the "tail" immersed in an appro-

priate solvent, contained in the lower section, and as in Ascending Chromatography, the solvent rises up the tail, then spreads through the paper disk horizontally, but the solvent front is circular in form. The rate of spread may be controlled by varying the width of the "tail".

This method produces circular bands instead of straight bands, spots, etc., and after allowing the "run" to proceed to a diameter of from 6–12 cm., development is carried out as in the previous methods. The same basic principles of solvent/solute are involved and the solute Rf. may still be calculated.

There are many more methods but almost all are based on one of the above five or a combination of two or more. It is claimed that the Ascending-Descending method of Bloch gives the most consistent results although for some purposes, e.g. amino-acid separation, it is a little unwieldy.

SOLVENTS

The operator has a wide choice of solvents, and the choice depends on the type of work it is intended to carry out, and the various reagents on hand.

For example (1) The most popular solvent used in the identification of urinary reducing substances is the N–butanol/acetic acid, consisting of four parts of N–butanol to one part glacial acetic acid and 5 parts of distilled water. After mixing, the mixture is allowed to stand until it has separated, and the upper layer is used in the chromatography trough. This solution should not be used for more than two days as esterifaction takes place on long standing, affecting its solvent properties.

(2) Liquefied phenol is commonly used for the identification of urinary amino-acids in the strip methods, and in two-way Chromatography, with the collidine-lutidine mixture.

(a) **Liquefied phenol.** A.R. Grade phenol is mixed with enough distilled water to make it sloshy, warmed to above room temperature approximately to 37°C., well stirred and allowed to stand. When separation has taken place, and the lower layer is clear, the lower layer is used.

(b) **Collidine-lutidine.** One volume of crude "2: 4: 6–collidine" (redistilled if very yellow) is mixed with one volume of "2: 4, –2: 5–lutidine" and two volumes of distilled water. The mixture warms up, and should be placed in a refrigerator until it is well cooled. It is then well shaken and allowed to warm to room temperature when separation will take place. The upper layer when clear is used.

DEVELOPERS

Like solvents, there are numerous developers, but the choice of a developer is dependent on the solvent used in many cases, as well as the necessity for its being suitable for the work in hand.

For example: (1) The most common developer for amino-acid detection is "Ninhydrin" in various concentrations ranging from 0.1% to 4%. Consden et al recommend an 0.1% solution in water-saturated N–butanol.

(2) For reducing substances the most common is benzidine in a glacial acetic acid/ethanol mixture. Horrocks recommends 0.5 gm. benzidine in 200 ml. glacial acetic acid and 80 ml. absolute ethanol. It is essential to dissolve the benzidine in the glacial acetic acid first before adding the ethanol, otherwise the activity of the developer may be impaired. This developer will stain most reducing substances with the possible exception of fructose, which may be identified by the use of a "Phloroglucinal" developer. It is always advisable to make duplicate "runs" when examining for reducing substances, in case it is necessary to examine for fructose, when the "Phloroglucinal" developer would be used; although it is possible to spray the original strip with this developer to identify fructose, if present, even after the benzidine developer has been used.

IDENTIFICATION OF CONSTITUENTS

By reference to tables of Rf. values or by running standard concentrations of known substances with the test, in the case of reducing substances, it is quite a simple matter to identify the various constituents contained in a solute under examination. It is possible to obtain quantitative results by Paper Chromatography in 48 hours which would take a week by other methods in some cases, or would present insurmountable obstacles to the attempted separation using such small quantities.

QUANTITATIVE ESTIMATION

There are two basic methods of quantitative estimation which, with slight modifications, are applicable to most paper chromatographic methods. These are:

(1) The Area and Intensity of Stain Technique,

(2) The Elution Technique.

The former is a relatively simple technique producing a reasonably reliable result in the minimum amount of time, while the latter is of more value in research where a much higher degree of accuracy is necessary.

(1) **Area and Intensity of Stain Technique.** It has been found that the size of the spot produced and the intensity of its staining reaction is directly related to the concentration of the substance present. The area of the "test" spot is found by the use of a planimeter, and the intensity of the stain produced is determined in an absorptiometer. The resultant from these above determinations is divided by the resultant obtained from a "spot" produced by a known amount of the substance similarly treated. When this answer is multiplied by the known concentration, it will give the concentration in the unknown sample. It is possible by this means to determine the concentration of a substance in a solution to an accuracy of + 5%.

(2) **Elution Technique.** In the elution technique the area of the dry spot is cut out of the paper after identification, and the substance extracted by refluxing the area with a known volume of water and a quantitative estimation carried out on this. For example:

In the case of reducing sugars any of the conventional methods may be applied, that of Somogyi being the most accurate. By this means, a quantitative estimation may be obtained to an accuracy of $\pm$ 1.5%.

In conclusion, I would like to point out the following salient features of Paper Chromatography.

In many fields it has been found possible to supersede the more tedious separation techniques with a Paper Chromatography Technique to advantage in time and material.

It has been found possible to separate and identify substances from mixtures of vitamins, anti-biotics, etc., in body fluids with rapidity and accuracy, which by other methods was both tedious and time consuming.

One very important application in Biochemistry is the identification of reducing substances in urine because of the number of confirmatory tests it has previously been necessary to carry out. The absence or presence of glycosuria in a patient from a clinician's point of view is of great importance, and the accuracy and reliability of the Paper Chromatography method of identification in this case is of great assistance.

SUMMARY

A brief review has been made of the history, uses and methods in the comparatively recent technique of Paper Partition Chromatography for the identification and estimation of substances in small quantities in solution, with particular reference to its uses in the field of Biological Chemistry.

REFERENCES

CONSDEN, R., GORDON, A. H., and MARTIN, A. J. P. (1944). *Biochem. J.*, **38**, 224.

CONSDEN, R., GORDON, A. H., and MARTIN, A. J. P. (1947). *Biochem. J.*, **41**, 590.

DENT, C. E. (1947). *Biochem. J.*, **41**, 240.

DENT, C. E. (1948). *Biochem. J.*, **43**, 169.

DENT, C. E., and SHILLING, J. A. (1949). *Biochem. J.*, **44**, 318.

PARTRIDGE, S. M., and WESTALL, R. G. (1948). *Biochem. J.*, **42**, 238.

HORROCKS, R. H., and MANNING, G. B. (1949). *Lancet* **1**, 1042.

BLOCK, R. J., LE STRANGE, R., and ZWEIG, G. (1952). *Paper Chromatography.*

ACKNOWLEDGMENTS

My thanks are due to the Secretary for Health, Federation of Rhodesia and Nyasaland, and to the Director, Public Health Laboratory, Salisbury, for permission to publish this paper.

☆ ☆ ☆

DAFFYNITIONS

Oxide — Technologist's epidermis.
Super-saturation — That one for the road.
Vital-staining — The application of lipstick.
Antibody — A person who objects to girls wearing Bikinis.
—From *"The Bacillus"*; Vol. 1, No. 3, and Vol. 1, No. 7.

A PRACTICAL PHYSICAL MODEL OF A PORTION OF THE LIVING UPRIGHT HUMAN SPINE

G. McMANUS

Department of Surgery, University of Cape Town

The human spine is a complex mechanism. It is, in fact, so complicated that our present-day knowledge of its working is still scanty. Ancient anatomists considered the human spine to be somewhat stiff, like a sjambok. They dissected the human body after death and deduced the way in which muscles worked. It is easy to see why they decided that, in order to bend a trunk in any direction, the muscles on the side to which the bending was to take place had to do the work. In other words, the muscles in front of a person were used to bend a person downwards to touch his toes, and the muscles at the back were used to bend him backwards. Research work carried out along electromyographic lines revealed that, in actual fact, the opposite muscle action was the case in the live upright person.

From electromyographic experiments it was learned that the human spine is, in fact, a system of balancing bodies. The weight at any one level of the trunk is taken through the vertebral body of the next level below. Stability is added between the vertebral bodies by the complicated mechanism of the interspinous discs and tissues.

By carrying out further experiments on spines which were taken from people who had recently died, it was possible to gain understanding of many of the mechanical factors which obtain in the operation of a spine. From the deductions which were thus arrived at, a theoretical model was conceived along mathematical and physical lines. The word "theoretical" is used because, in the first instance, the design of a model was essentially a paper design and had not been made in practice. While in Liverpool some years ago, Professor C. E. L. Allen constructed the first model obeying these mathematical and physical principles. The model was crude because the apparatus obtainable at the time was far from perfect.

In order to teach the mechanisms of spinal function and to carry out further research into the way in which such a physical model would behave, and then re-apply the findings to the factual consideration of clinical cases, it was decided that a similar but more accurate model should be constructed at the University of Capetown. Two separate models have been constructed, the first being somewhat of an experiment and, therefore, not too successful, and the second being the final model constructed after learning certain lessons from the first.

The final model was constructed of corks cut to resemble, roughly,

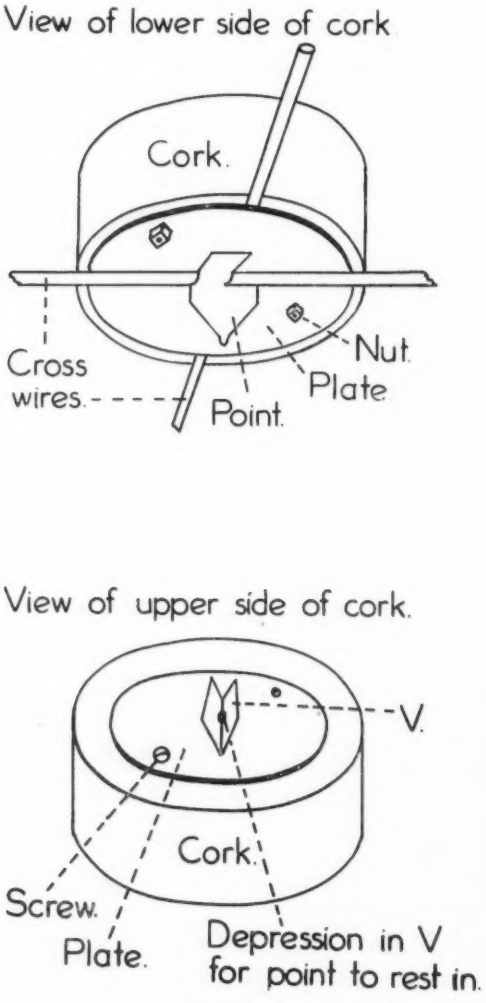


FIGURE I

the vertebral column, becoming smaller as one was balanced on the other.

Sixteen segments were used. More could have been added. Each segment was an absolutely independent section, not being attached per-

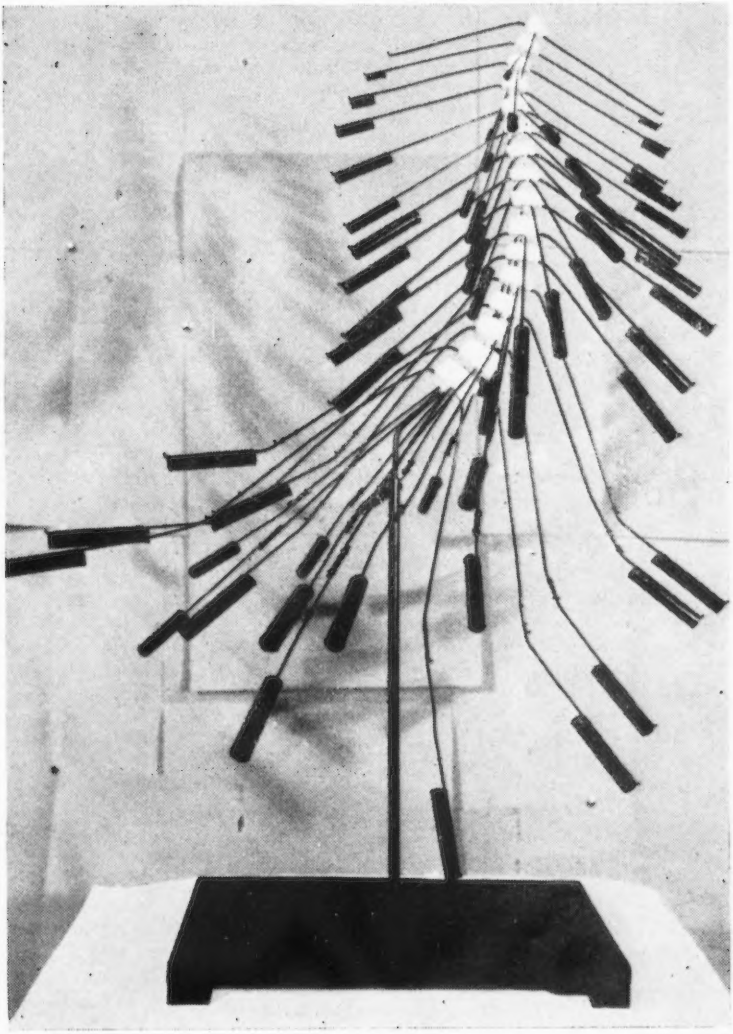


FIGURE II

manently to the section above or below. It could be lifted apart at any desired level and each section would automatically take up a new position and remain balanced. The model was able to demonstrate a sideways bend to left and right, backwards and forwards; it could turn left and right and would always return to its original position.

Each cork, representative of a vertebral body, had fastened to its upper surface a plate with a small V of metal to prevent the section on top from slipping off the one below. There was a slight depression in the centre of the V in which a point protruding from the under surface of the next cork above rested. (See Fig. I.) The V allowed a reasonable range of movement in any direction, while the metal balancing point would require considerable force to dislodge it from its retaining depression.

The plate attached to the underside of the cork had cross wires attached. The more the crosswires were bent downwards below the centres of their respective corks, the more stable the balancing system became. Containers for the balancing weights were, in turn, attached to the ends of these wires. This can be seen in Fig. II. The two metal plates were attached to the corks by two nuts and bolts passing through the metal plates and the cork.

As the balancing of sections on each other proceeded downwards, it was found necessary to increase the length and strength of the wires and size of the containers for holding the balancing weights.

Should the weight in one of the higher containers be changed appreciably, it was found necessary to compensate balance all the way down to the bottom of the model. The process of adjusting balance of the model had to start from the top. Placing No. 1 on the top of No. 2 and re-balancing both, next 1 and 2 were placed on No. 3 and re-balanced, and so on until all sections had been correctly balanced.

The points upon which each cork balanced on the one below were shaped to enable sideways rocking. This effect was obtained by angling the points 45 degrees from the horizontal. (See Fig. I.)

Lead shot was used for ballast in the containers which were subsequently corked to prevent spilling when the model was being demonstrated.

The detailed scientific study of such a system of balancing bodies becomes very complex indeed. It is hoped that members of the Department of Physics and Applied Mathematics will delve into this problem and assist the Orthopaedic world to get nearer the explanations of the shape, movements and behaviour of the human spine. At least, we feel that it is high time that the "leaning Tower of Pisa" should be put in the shade by the type of balance which obtains in our modern world.

There might be giddier things to come!

ACKNOWLEDGMENTS

I would like to thank Professor C. E. L. Allen, Department of Orthopaedic Surgery, University of Cape Town, for his helpful guidance and assistance with this paper.

ACCURACY AND REPRODUCIBILITY OF ASSAY VALUES IN CHEMICAL PATHOLOGY

S. M. JOUBERT

Central Pathological Laboratory, Natal Provincial Administration, Durban

Chemical assay involves the qualitative and quantitative estimation of substances. It is clear that if the results of an assay are to have any significance, the investigation must be designed both on a qualitative and a quantitative basis. Accuracy and reproducibility of assay values is a problem which is fundamental to all analytical chemistry, including chemical pathology.

The entire discipline, inherent in the theory and practice of analytical chemistry, is designed to satisfy these basic criteria of accuracy and reproducibility. The human element in the performance of the tests, however, remains a constant source of error, necessitating the design of ways and means of checking results. Such checks are essential in routine chemical pathology. The quality of the human material varies widely, and the division of labour in a pathological laboratory amplifies the variability of the human element.

How, then, can suitable check methods be designed?

Viewed in its entirety, it is possible to design check methods at every stage in technique. Such methods, of course, are part and parcel of instructional exercises: standardising weights, pipettes, volumetric flasks, etc. These procedures are possible but impracticable for general application. Certainly, somewhere in the organisation standardisation of equipment is obligatory, but generally this cannot be applied to each individual worker without serious infringement of output.

A more omnibus design would be to duplicate or triplicate each assay, bearing in mind that a procedure of this nature can only assess reproducibility and gives no pretence at assessing accuracy. Quite apart from this objection, it is clear that duplication or triplication must of necessity adversely affect the cost structure of a laboratory. As a check method, it is not one of choice in routine practice. The design of most methods of assay, indeed all methods of assay, is to compare the unknown with known quantities. In other words, standards are provided or available, some of which may be qualitatively identical to the substance to be measured, while others may be qualitatively dissimilar, but physically comparable. Physical comparability of qualitatively dissimilar substances is a contentious issue, the pros and cons of which are not the subject of discussion. It is accepted that in adopting a method these aspects will have been evaluated carefully. Germane to the present argument is the value of standards as a check to accuracy. There can be little argument as to their value. The construction of standard graphical representation

as a replacement for standards is a practice to be avoided. Admittedly there are instances where standard graphical representations are desirable, when standards are impracticable, but these should be checked frequently and at regular intervals and should not become a substitute for standards where these are readily available. Nevertheless, standards are only a partial check; they cannot check the preparation of the standard itself.

There remains the procedure of issuing a standard sample, containing a known amount of the substance or substances to be assayed. In its simplest form this usually means that the pure substance or substances are weighed out accurately and made up to a suitable concentration prior to distribution. To this method there are objections. Usually, distilled water is the solvent, and no interfering substances are present. A specimen of this nature can hardly reflect errors in manipulative technique as compared with specimens of body origin. Again, some substances are not available in pure form, or, if they are, their cost is prohibitive. In other instances a complexity of substances are assayed, making use of a common reactive chemical group. These conditions can hardly be simulated by a pure substance in watery solution. Using body fluids or products as solvents or dispersing media respectively, introduces the problem of accurately assaying quantities present in these body fluids or products prior to the addition of the pure substance. Standard specimens are indeed available in some overseas countries, being issued by National bodies. If these were freely available they would go a long way towards achieving a real and valuable check on accuracy and, by repetition, on reproducibility. However, at present these standard specimens are not freely available in the Union and their preparation by individual laboratories is beyond the scope of their set purpose. Using pure substances to compound a simulated serum has little application, as such solutions are no more than simple solutions in water, introducing the problems of solubility products, non-solubility and incompatibility. Serum holds most substances in solution by virtue of protein-bound complexes. This manifestly cannot be achieved artificially.

Having considered some ways of checking accuracy and reproducibility of results, it is obvious that none of these procedures can be adapted exclusively to routine work. Yet, equally obvious is the obligatory check on results. It is not enough to claim experience, or give opinions on accuracy. No matter how experienced a worker may be, claims put forward can carry no weight unless these are supported by conclusions drawn from experiment. On this basis any argument is open to settlement by the simple expedient of repeating the experiment. It is precisely in this manner that the problem of checking results can be solved. An experiment is designed and carried out. The technicians performing the tests are asked to repeat it.

In practice the design is quite simple. The serum, blood or other body fluid to be analysed is taken and a triplicate assay carried out for a particular substance. This serves as a base line. If the analysis is

accurate, a series of concentrations can be prepared, using the value obtained, by dilution of the specimen and addition of the pure substance. Duplicate assays are carried out on each specimen of the series thus prepared and the calculated and assay values are compared. To exemplify the principle; if, say, a serum sample gives a triplicate assay value of 4.0 mgm.% uric acid, it is easy to prepare a series of sera containing 2.5 mgm.%, 5.0 mgm.%, 8.0 mgm.% and 10.0 mgm.% by diluting and adding uric acid. Duplicate assay values will show to what extent these figures can be reproduced and whether the error is within the limits claimed for the method. The specimens thus prepared are circulated. Where the pure substance required to make up the series is not readily available—to cite one example; bilirubin—a pathological specimen is taken and by dilution a series is prepared, based on the original assay value.

Most routine assay values can be checked in this way. A series is prepared monthly by a senior and circulated. Results are recorded and kept for reference. The various assay methods are systematically checked in rotation with no serious infringement of time and no excessive cost. Above all there is the satisfaction of knowing that the endless stream of assay values flowing from the laboratory bear some relationship to truth; or, if this is not the case, it is at least plain where remedial action must start.

An obligatory, if somewhat irksome, discipline for routine laboratories has been outlined. How many, one may ask, existing laboratories can justify their being on the basis of results flowing from such a check?

☆ ☆ ☆

TO STUDENTS AND OTHERS

M. D. WICKHAM

Department of Pathology, Faculty of Medicine, University of Natal

The examinations are over. Students in Natal can breathe a little more freely with the Bacteriology final behind them. The results are known and by now have no doubt been fully discussed. An unpleasant subject, examinations, but unfortunately they play a very necessary and important role in any recognised system of education. There must be a few unsuccessful candidates, who have regretfully rebuked themselves for not having applied their abilities more diligently to their studies. These few know that procrastination, laziness and general disinterest may have shared a major part in the cause of their downfall. Only application and concentration can remedy these defects.

The successful candidates have no cause for that feeling of condescending smugness that arises from their *alter ego*. They could, perhaps, have bettered their examination results. "Why?" they shout, with one accord, "We are through the exam. Is that not enough? Why

should we have mopped our fevered brows and pushed our overworked brains any harder?" Why indeed? The answer lies not so much in the fact that their marks might have been improved upon, but in that the subjects studied by today's medical technologist trainees demand far greater individual attention than ever before. There are innumerable ramifications to one subject, which, while they need not all be asked the candidates by the examiners, deserve more than a cursory glance during the period of intensive study, prior to the examinations. To qualify adequately in a subject, a student should have a working knowledge of all the finer points of the subject. To do so might be hailed as the precursor of specialisation. But is that so deplorable a consequence that it does not warrant encouragement by those on whom the burden of educational organisation has fallen?

At the present moment, our laboratory service, as we know it, prevents any but a small minority from pursuing this trend in training. The accumulation of knowledge is unceasing, as should be the quest. Man has an insatiable appetite for the facts concerning his existence and well-being. While these qualities lie dormant in most people, they should be the natural characteristics of a technologist, medical or otherwise. Thus, it is for the junior of today, the senior of tomorrow, to cultivate this curiosity and, in doing so, not only ask the question why, but also how? Even the simplest of techniques, the most boring and routine examinations may well be modified. Efficiency may be increased, time may be conserved or results may be improved upon. To the ingenious mind the original thought comes easily.

Not all of us are fortunate enough to be endowed with the maximum of intelligence and so, without the necessary encouragement, may fall into the slothful habit of letting others do our thinking for us. One useful way to maintain an interest in a subject is to read what our predecessors had to say in the past. Agreement or disagreement with previous comments may ignite that spark from which ardent enthusiasm stems. It is this quality which leads the inquisitive mind to delve further into the many and varied problems so often encountered. Emanating from constructive criticism may come some radical idea. Upon further development, following due consideration, a practical modification could well be derived and usefully employed.

As stated, these ideas may find their source of origin in the articles published in periodicals and journals to be found in the adequate library facilities provided by any progressive type of laboratory service. If the necessary journals are not immediately available, there is a mechanism whereby they may be borrowed from long established institutions, thus providing an invaluable source for research into earlier material published. Another source of noteworthy importance is that collection of dusty books on the laboratory shelf. Some are referred to daily, others do not enjoy this privilege and huddle together in seeming obscurity. It is from the latter that a surprising degree of useful substance may be extracted. Perhaps they are not the accepted textbooks of the day, nevertheless

they represent, in all probability, a different and interesting point of view. One published procedure may be followed in the laboratory at present, but it is from the general consensus of opinion that the future trends of development are invariably indicated.

From this it is seen that it is important for the trainee to learn not only that which the lecturer places before him, but also the wider aspects found in the literature embracing the subject. It is difficult for the lecturer to handle more than a relatively small, but important, section of the prescribed syllabus, as the time at his disposal is somewhat limited. Needless to say, not all the matter published can be digested in the last few moments of cramming and it is suggested that regular attention be paid to the latest journals published, while the various textbooks be consulted when lectures were pertinent to their content. Any reasonable lecturer would willingly supply the necessary guidance and direction, should he be approached by the interested student.

These suggestions seem to impose a further burden on the supposedly overworked trainee, but half an hour a day could profitably be spent in the library. It is certainly no more than the average university student might be expected to endure. While it may well be argued that the course for medical technologists is not as intensive as that of a science degree, it is nevertheless becoming, year by year, a more technical and highly skilled occupation. The recent advances in biological chemistry with associated electronics and mechanics demand that the technologist of today be more progressive in outlook. He must be conversant with the modern techniques of his own field as well as those of the interrelated sciences if he is to maintain the high standard expected of him. The achievement of this goal in the future can only be attained if greater interest is engendered by the generally indolent student of the present.

☆ ☆ ☆

TISSUE CULTURE

(Synopsis of a lecture given by Dr. E. E. Rosenberg, Senior Lecturer in Histology at the Faculty of Medicine, University of Natal, to the Natal Branch of the Society on 10th November, 1955)

Dr. Rosenberg stated that his lecture would deal with an aspect of his research and expressed the opinion that the subject was one of growing importance.

The lecturer stated that for thousands of years man has taken cuttings from plants and grown them successfully. It was surprising that the same methods applied to animals—that is, the taking of grafts and the successful cultivation of grafts—should have been delayed until the 20th Century. The reasons for this delay were two-fold.

Firstly, an appreciation of the fact that though an animal as a whole was subjected to a variety of external conditions, its individual cells remain in much more constant surroundings. These cells which are

sheltered from chances and changes in the outside world can specialise in the performance of their functions. As the cells of higher animals specialise, they lose their independence. Before parts of animals can be cultivated away from the host it is essential to emulate the conditions obtaining in the animal; namely, the pH, the concentration of various ions, the temperature, etc. It is only recently that man has had sufficient knowledge of the conditions inside the animal body to be able to create similar conditions in test-tubes and other containers and so allow for the growth of cells, tissues and organs *in vitro*.

Secondly, an appreciation of the fact that when cells are removed from the body they are deprived of the body's defence against bacteria. It is again only recently that man has developed rigid aseptic techniques which will allow for the successful cultivation of cells *in vitro*.

It has been shown that cells, with one exception, must have a solid surface on which to grow for any length of time. This solid surface in the simplest techniques is provided by the coagulum produced by the interaction of adult rooster plasma and an aqueous extract of chick embryos. The cells are inoculated onto this substrate, which is used in the form of a hanging drop.

The lecturer stated that greater multiplication takes place at higher temperatures, but there is, of course, an upper limit. At low temperatures, growth rate is depressed.

The audience were shown photomicrographs of cell colonies, demonstrating clearly the difference in outgrowth from "ex-plants" following incubation for 19 hours and 40 hours. Further pictures revealed under high magnification the nucleus, nucleolus and fat droplets of cultured cells. It was stated that phase-contrast microscopy is particularly useful for this type of work; but that, with few modifications, normal histological staining techniques can be applied after removing the cover-slip from the slide colony. Growth of the cells can be conclusively demonstrated by the presence of cells undergoing division; and cell counts, giving the proportion of cells in division to resting cells, constitute one of the methods used for determining growth rates. A further lantern-slide was shown of a chick nerve cell growing *in vitro*.

The limitations of the hanging-drop preparation were three-fold; the shortage of oxygen, the use of a medium of somewhat indefinite constitution, and the accumulation of breakdown products. Various measures have been introduced to overcome these limitations, such as the use of bigger concavities for hanging drop preparations, and the removal of waste matter by washing and changing the media. One particular container used for cell culture is called a Carrel flask, and it has been used to perpetuate growth of chick cells serially for thirty-five years; long, in fact, after the death of both the original chicken and the inventor of the container. Another technique is that of the roller-tube, in which the tube containing nutrient media and carrying cell colonies is rotated seven to twelve times per hour in order to subject the growing

colonies to alternating gaseous and fluid phases. This medium is fairly economical and easily handled but is not suitable for high power microscopy. It was stated that a variety of other containers have been tried and found useful for various purposes.

Dr. Rosenberg dealt at some length with the applications of tissue culture methods. Hsu has studied the chromosomes of epidermal cells cultivated *in vitro* and has been able to determine the sex of pseudohermaphrodites. Dr. Peter Gaillard of the University of Leyden, using cell-culture techniques, was able to produce parathyroid hormone from the cells of a parathyroid gland removed from a still-born child, the hormone being used for the treatment of persons after inadvertent parathyroidectomy. In view of the world shortage of insulin, Dr. Rosenberg speculated that it may be possible to grow pancreatic tissue *in vitro* and at a later stage transplant this tissue to diabetics. Similarly, it has been possible to dispense with the present use of animals for the assay of certain drugs, and these drugs have been assayed using cell cultures which are more economical. Dr. John Biesele, investigating the differential susceptibility of normal and cancerous cells to various substances, discovered that diaminopurine was particularly effective against the latter; the drug has now been used clinically for the treatment of leukaemia.

It was explained that tissue culture is a useful method in the study of viruses. Normally, a large number of animals are required for virus work, but tissue culture may at times be substituted. As, for example, when crushed monkey kidney is grown for 6–8 days by the roller-tube technique, inoculated with poliomyelitis virus and, after a few days incubation, formalized. This is the basis of the technique used for producing the Salk "anti-polio" vaccine. Known antibodies can be added to the kidney culture before the poliomyelitis virus is introduced and in this manner the virus van be typed.

The lecturer said that one of the big problems was to produce a cheap synthetic medium in which cells will grow. If this can be achieved then a vast quantity of hormones can be produced from various endocrine glands.

As a sideline, it was mentioned that cells in tissue culture can become addicted to a drug, e.g. morphia. It was mentioned also that it has been observed that cancer cells remain cancerous even after prolonged cultivation in tissue culture, but that normal cells may become cancerous during culture. The reason for this malignant change may throw light in the field of oncology.

Dr. Rosenberg ended by saying that in his opinion tissue culture is destined to play a dominant part in medical science.

At the conclusion of the lecture, Dr. Rosenberg answered numerous questions, which reflected the obvious appreciation of the lecture and interest in the subject by the unfortunately small audience.

P.N.B.

INTERNATIONAL CONGRESS OF MEDICAL LABORATORY TECHNOLOGISTS

This international organisation was formed during the Nottingham Conference of the Institute of Medical Laboratory Technology with the aim of furthering international co-operation between Medical Technologists. The South African Society has applied for membership, and it is hoped that, amongst other things, an international exchange of Journals will take place.

The first North American conference of the International Congress will take place in Quebec, Canada, from June 17th to 22nd, 1956. The American and Canadian Technologists have extended a cordial invitation to any members of this organisation who may be in a position to attend as well as to the official delegates of the constituent Societies of the International Congress.

Readers may obtain further details from the Hon. General Secretary of the South African Society.

The Institute of Medical Laboratory Technology, 9, Harley Street, London W.1, announces that its Journal will be made available to *bona fide* members of the organisations represented on the I.C.M.L.T. at the reduced rate of £1. The normal subscription is £2/2/-.

☆ ☆ ☆

SOCIETY NEWS

NATAL BRANCH

DURBAN

On the 24th November, an Extraordinary General Meeting of the Branch was held to discuss a motion, proposed by Mr. C. J. Scholtz on behalf of the Branch Committee, in connection with a domestic dispute. The defeat of the motion by the members present resulted in the resignation of the Branch Committee, and a management committee, consisting of Mr. G. W. Wikeley, Mr. J. Greenstein and Mr. M. H. Lello, was elected to carry on Branch affairs until the Annual General Meeting in April.

At a meeting held on January 19th, Dr. S. M. Joubert spoke to an interested group of about 30 members on "Fat Intake and Coronary Thrombosis". Dr. Joubert's interesting and informative talk was greatly appreciated.

Management Committee: Chairman - - Mr. J. Greenstein
Vice-Chairman - Mr. M. H. Lello
Hon. Sec./Treas. - Mr. G. W. Wikeley

G. W. WIKELEY,
Hon. Sec./Treas.,
Central Pathological Laboratory, P.B. Jacobs, Natal.

* * *

STUDENTS' SUB-SECTION

For its December meeting, the Students' Sub-section organised a party-dance in the new tea-lounge of the Central Pathological Laboratory, Wentworth. The occasion was much enjoyed by all who attended, coming, as it did, in the midst of the festive season.

In January we commenced our activities for 1956 by holding another debate at the Durban Blood Transfusion Service.

We should like to record our thanks to Mr. P. Buck for his assistance in organizing the dance, and for acting as chairman at the debate.

A. J. S. GREENFIELD,
Acting Student Representative.

* * *

PIETERMARITZBURG

Pressure of work has once again prevented any activities in the way of lectures and film shows from being held in this centre. However, in spite of this difficulty, several members were able to make the journey to Durban for the Special General Meeting of the Natal Branch in November.

The end of the year brought the Intermediate Examinations and we are happy to report the success of the six Pietermaritzburg candidates—three from Grey's Hospital and three from Edendale Hospital.

It must be pointed out that no system of organised lectures has been available in this area, and tuition has been left to the senior staff of the two laboratories, as and when time permitted. Thus, the 100% pass in this centre is indeed a great achievement.

This question of organised lectures in Pietermaritzburg is one that requires a definite solution as soon as possible, as the future of new students in this area is very dark. It is easy to appreciate the handicap experienced by students in this area, where the tuition is dependent on

the available time and goodwill of the senior staff. There are many difficulties to be overcome in that the two hospitals are situated some seven miles apart, one in town, the other out of town, and the question of a suitable venue must be decided. Both European and Non-European students must be catered for. Furthermore, official lecturers must be appointed and a suitable supply of reference books must be made available to the students.

It is, therefore, not perhaps out of place to raise this problem as our students will very soon be faced with their Final Examination and are entitled to organised tuition as in other centres. Perhaps the Branch Executive may investigate the matter.

M. H. LELLO.

* * *

NOTES FROM EAST LONDON

In common with most public institutions, we are at present suffering from an acute staff-shortage. We have eight vacancies—that is to say, nearly 50% of our establishment—and extensive advertising has elicited no response whatever. The reason is not hard to find: it is simply that our salary scales cannot compete with those offered by commerce. No matriculated boy with any ambition is going to take a job at £20 a month (with the prospect of five years' hard work before he can be qualified) if he can **start** in the gold mines at £46. No girl is likely to come to us when, with very little ability at typing, she can get £35—and probably £50 after a year's experience!

What's to be done about it? The answer is obvious, but it is extremely doubtful whether paying beginners considerably more than they are worth in order to tide the laboratory services over a difficult period is in the best interests of the country as a whole. It would be better in the long run if we cut the coat according to the cloth—that is, if we restrict the work according to the available staff. A moderate tightening-up on the intake of specimens might be quite a good thing. All laboratory staff must at times feel some concern over the large number of unnecessary investigations they are called upon to do. Very many specimens could be refused without being detrimental to the patient in any way. Routine haematology typifies what I mean: how many "full" blood counts are done in cases where either a red or white cell count would be sufficient? Ministerial admonitions to work harder are merely irritating to personnel already grossly overworked. It seems to me that in the restriction of work lies the best answer to the staff shortage.

H. FLEETWOOD-HOWARD.

CAPE BRANCH

At a Special General Meeting held on Monday, November 28th, 1955, the members present decided not to hold any lectures, talks or demonstrations during the summer months. These will be resumed after the Annual General Meeting to be held in April, 1956.

Also at the November meeting the Committee Members for the year 1956 to 1957 were nominated. From those members accepting nomination in writing the Committee will be elected at the April Annual General Meeting.

J. H. MAYTHAM,
Hon. Sec./Treas.,
Dept. of Bacteriology, Medical School, Mowbray, C.P.

* * *

SALISBURY AND DISTRICT ASSOCIATION

The first Annual Dinner and Dance was recently held by this Association at the Quorn Hotel, Salisbury. Twenty-seven couples were present, and the evening was a great success.

The Committee has drafted out a half-yearly programme which should be of great interest to members and in keeping with the high standard of previous lectures.

N. R. GREGORY,
Hon. Sec./Treas.
P.O. Box 8079, Causeway, Salisbury, S. Rhodesia.

* * *

THE THREE LAWS OF RESEARCH

First Law — Pick men of genius and industry.
Second Law — Give them what they need.
Third Law — Leave them on their own to get on with the job.

—From *"Chemical and Engineering News"*, 4th April, 1949.

* * *

"Data that are worth collecting are also worth analysing by statistical methods."

—From *"Use of Statistics in Medical Papers"*.
SCHREK, R. (1955). *Amer. J. clin. Path.* **25**, 429.

RANDOM MEANDERINGS

ODE TO PATHOLOGISTS

Pathologists are gentlemen who're very, very wise,
They can tell you all the wherefores, and the hows and whens and whys.
Oh, great's their erudition, their benevolence and fame,
And the layman stands awe-smitten by the mention of a Name.
The practitioners are helpless and the lab. technicians dumb
Till the Mighty Man has spoken, and the words of wisdom come,
And they rush around in circles, and they tear out chunks of hair,
As they look for a pathologist—who's never, never there.

Pathologists are busy men, their time is very dear;
Their lists of Urgent Things to Do would stretch from there to here.
They're always very helpful, and delighted to assist
A befuddled Lesser Creature who is struggling in a mist.
They always know the answer, and exactly what to do,
And they'll cure your biggest headaches with a single word or two.
They're the only ones to help you, they're the answer to your prayer.
But the problem is to find them—they are never, never there.

They may be in the hospital, deciding patients' fates,
Or engaged in earnest conclave with a colleague from the States,
Or performing a post-mortem, or dictating, by the way,
Their latest learned papers for the worthiest M.J.
They may be at a conference, or six feet under ground,
But the only things that's certain is—they're nowhere to be found.
They seem to have a habit of dissolving into air,
You can search both high and low for them—they're never, never there.

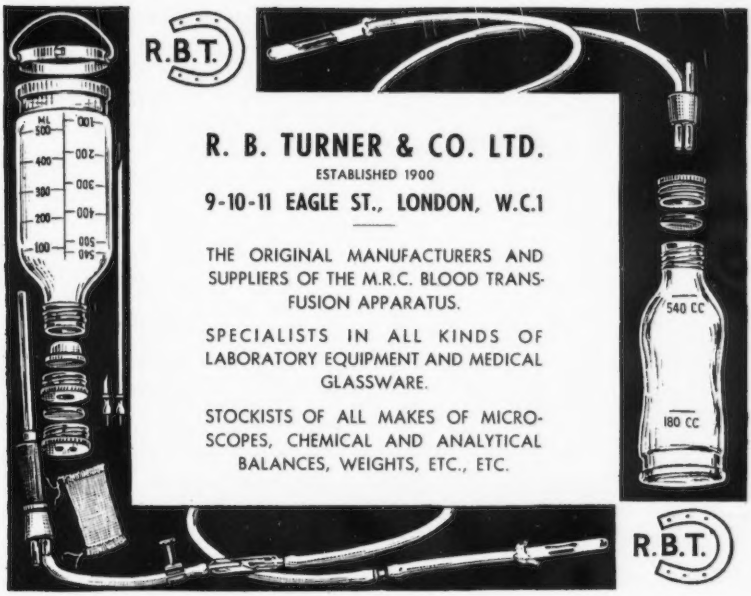
Pathologists are people with initiative and sense.
They're always very up to date with medical events.
They get stacks of periodicals they read from end to end,
And their shelves are packed with volumes that they're always pleased to lend,
And reprints from acquaintances arrive with every mail
Till the contents of their crania make lesser mortals quail.
We treasure our pathologists—that race remote and rare;
But when we need them urgently—they're never, never there.

"Nerilla"

FOR ADVERTISING SPACE IN THIS JOURNAL

Apply:

ADVERTISING MANAGER,
C/o CENTRAL PATH. LAB.,
PRIVATE BAG JACOBS,
NATAL.


R.B.T.
R. B. TURNER & CO. LTD.
ESTABLISHED 1900
9-10-11 EAGLE ST., LONDON, W.C.1
THE ORIGINAL MANUFACTURERS AND SUPPLIERS OF THE M.R.C. BLOOD TRANSFUSION APPARATUS.
SPECIALISTS IN ALL KINDS OF LABORATORY EQUIPMENT AND MEDICAL GLASSWARE.
STOCKISTS OF ALL MAKES OF MICROSCOPES, CHEMICAL AND ANALYTICAL BALANCES, WEIGHTS, ETC., ETC.
540 CC
180 CC
R.B.T.

STUART JONES & DAVID ANDERSON LTD.

20 QUEEN STREET + DURBAN

☆ ☆ ☆

● WE ARE PROUD OF THE FACT THAT WE HAVE SUPPLIED MUCH OF THE EQUIPMENT NOW IN USE IN THE LABORATORIES OF THE NATAL PROVINCIAL ADMINISTRATION.

We extend a cordial invitation to visit our showroom at the above address.

Natal Agents for:

Baird & Tatlock (London) Limited, W. Edwards & Co. (London) Limited, Hilger & Watts Limited, Hopkin & Williams Limited, Watson & Sons Limited, G. T. Guur.

NEW **BENCH TYPES**

MSE Centrifuges

Featuring

"SUPER MINOR"		"MULTEX"-INTERMEDIATE
ENCLOSED ROTATING WINDSHIELD	☆	ENCLOSED ROTATING WINDSHIELD
SWING OUT AND ANGLE HEADS	☆	SWING OUT AND ANGLE HEADS
4,500 r.p.m. – BOTH HEADS	☆	4,000 r.p.m. – BOTH HEADS
10, 15 AND 50 ml TUBES	☆	15, 50 AND 100 ml TUBES
TUBES SWING IN "STILL AIR"	☆	TUBES SWING IN "STILL AIR"

S.A. Agents and Stockists:

MACDONALD ADAMS & Co.

P.O. Box 68 + Phone 238161
JOHANNESBURG

P.O. Box 1807 + Phone 60888
D U R B A N

NOTICE TO CONTRIBUTORS

All contributions are to be addressed to:—The Editor, "The South African Journal of Medical Laboratory Technology", Laboratory, King Edward VIII Hospital, Durban, Natal.

Contributions may be written in English or Afrikaans, and should preferably be typed in double-spacing on foolscap sheets on one side of the paper only.

Figures should be drawn in Indian ink, and all figures and tables should be labelled as such (e.g. Figure 1, Table 1, etc.).

Authors should make adequate references to previous works on their subjects. These should be set out as follows:—Author's surname and initials of Christian names; the year of publication (in parentheses); the name of the journal, which should be abbreviated according to the World List of Scientific Periodicals (see below); the volume number (underlined); and the first page reference.

Example:—Moron, I. B. (1960). J. unsuccess. Med., 20, 99. References to books should give the author's name and initials, the year of publication, title of book, name of publisher, and town in which published.

References should be arranged in alphabetical order of the authors' surnames. If more than one work by the same author is listed, these should appear in chronological order.

Technologists are reminded that regulations demand that all original articles of a technical or scientific nature must be approved by the heads of their departments before being submitted for publication.

Title abbreviations according to the World List of Scientific Periodicals

All nouns are given capital letters, and adjectives small letters. Articles, conjunctions and prepositions are omitted.

Examples:—

J. Amer. med. Ass.	*S. Afr. J. clin. Sci.*
Lancet	*Stain Tech.*
Amer. J. clin. Path.	*J. Bact.*

REPRINTS AND PHOTOGRAPHS

If requested before publication, 24 reprints of original articles will be supplied free to contributors. As a temporary measure, contributors are asked to defray the costs of publishing photographs accompanying articles.

KENNISGEWING AAN INSENDERS

Alle bydrae moet as volg geadresseer word:—Die Editeur, „Die Suid Afrikaanse Joernaal van Mediese Technologie", Laboratorium, King Edward VIII Hospitaal, Durban, Natal.

Bydrae mag in Engels of Afrikaans geskryf word en moet verkieslik getik wees dubbel spasiering op folio-papier en net op een kant van die vel.

Figure moet in Indiese ink geteken word en alle figure en tabelle moet geëtikeer word as sulks (b.v. Figuur 1, Tabel 1, ens.).

Auteurs moet voldoende referensies gee tot vorige werke oor hulle onderwerpe. Die moet as volg uiteengesit word:—Auteur se familienaam en voorletters; die jaar van uitgawe (in hakies); die naam van die Joernaal, wat moet verkort word volgens die Wêreld Lys van Wetenskaplike Tydskrifte (sien hieronder); die volume nommer (onderstreep); en die eerste pagina referensie.

Voorbeeld:—Moron, I. B. (1960). J. unsuccess. Med., 20, 99. Referensies tot boeke moet die auteur se naam en voorletters meld, die jaar van uitgawe, titel van boek, naam van uitgewer, en stad waar dit gepubliseer is.

Referensies moet in alfabetiese orde, volgens auteurs se familiename gerangskik word. Indien meer dan een werk deur dieselfde auteur gemeld word, moet dit in tydsorde voorkom.

Tegnoloë word daaraan herinner dat regulasies vereis dat alle oorspronklike artikels van tegniese of wetenskaplike aard moet die goedkeuring dra van hulle departementale hoofde voor dit ingestuur word vir publikasie.

Titel verkortings volgens Wêreld Lys van Wetenskaplike Tydskrifte

Alle selfstandige naamwoorde moet begin met hoofletters en byvoeglike naamwoorde met klein letters. Artikels, verbindings en voorsetsels word uitgelaat.

Voorbeelde:—

J. Amer. med. Ass.	*S. Afr. J. clin. Sci.*
Lancet	*Stain Tech.*
Amer. J. clin. Path.	*J. Bact.*

HERDRUKKE EN FOTOGRAWE

Indien aanvraag ingedien word voor publisering, sal 24 herdrukke van oorspronklike artikels vry aan bydraers verskaf word. As in tydelike maatreel word bydraers gevra om die koste van publisering van fotos wat saam met artikels gaan self te betaal.

when you want to control OEDEMA
think first of . . .

Diamox*

Acetazolamide Lederle

A nonmercurial oral diuretic. Acts by inhibiting the enzyme carbonic anhydrase. Produces prompt, ample diuresis lasting from six to twelve hours. Morning dosage allows an uninterrupted night's sleep. Well-suited to long-term use. Nontoxic.

The most widely prescribed drug of its kind !

Indicated in cardiac oedema, epilepsy, acute glaucoma, premenstrual tension, oedema associated with toxaemia of pregnancy and oedema caused by certain types of electrolytic imbalance. Offered in scored tablets of 250 mg. for oral use.

PACKED IN BOTTLES OF 25 AND 100

*Regd. Trade Mark

LEDERLE LABORATORIES DIVISION
AMERICAN CYANAMID COMPANY
PEARL RIVER, NEW YORK

Lederle

Sole South African Distributors:

ALEX LIPWORTH LIMITED

JOHANNESBURG ◆ CAPE TOWN ◆ DURBAN